Spring starts with a mild and wet March

Description

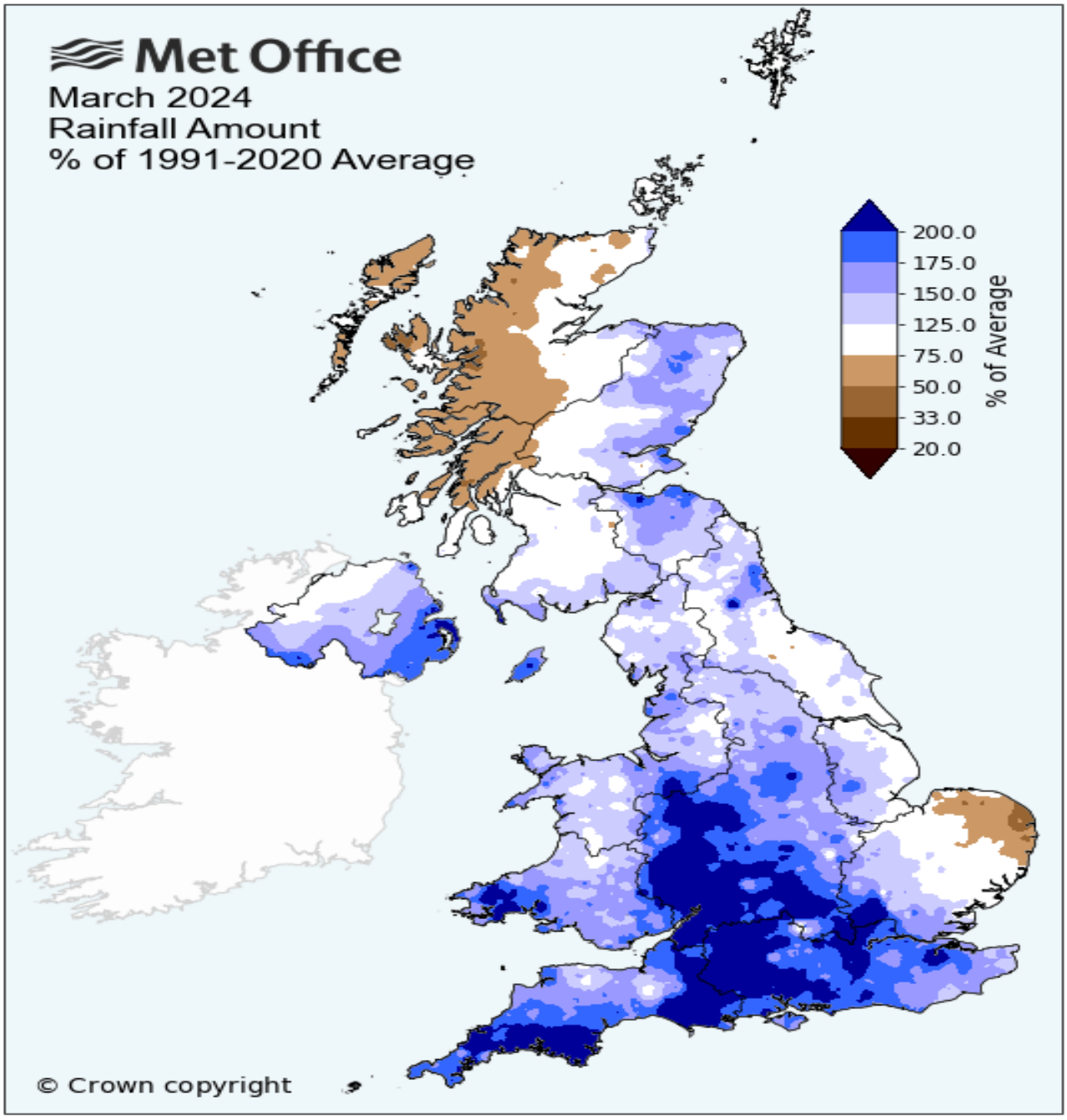
Meteorological spring kicked off with a mild and wet month of weather for the UK, with southern areas particularly wet compared to average.

Although it’s felt like it hasn’t stopped raining for many, no national records have been broken and March 2024 will go down as a wet and dull month, according to provisional statistics from the Met Office.

Wetter than average

The UK experienced 27% more rainfall than an average March, with much of this concentrated in the south. A number of counties saw at least double the amount of rainfall they would expect for the month, including Cornwall, Dorset, Gloucestershire, Hampshire, Wiltshire and Worcestershire.

Although Scotland experienced widespread rain throughout the month, it was drier than average, especially in northern and western areas.



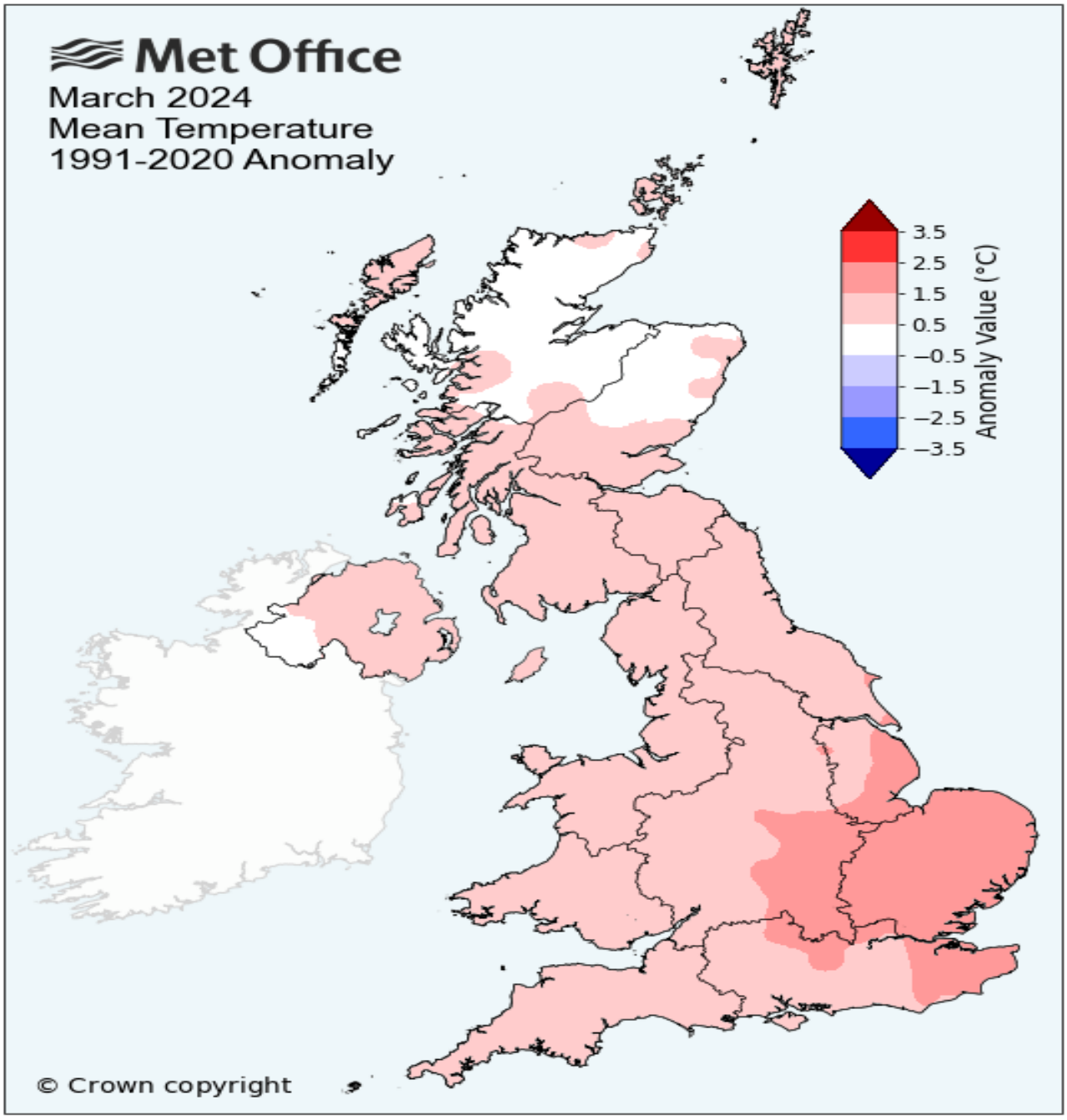
A mild month

The month started cooler than average, with some snow falling early on. But this cool weather was soon replaced with milder conditions for much of the rest of the month, with only brief cooler interludes at times.

Overall, the provisional mean temperature for the UK was 6.7°C, 1.0°C above average. Southern England was much milder than areas further north, with a mean temperature of 8.2°C (1.4°C above average). Scotland was the coolest region, recording an average temperature of 5.0°C – just 0.6°C above average.

England provisionally recorded the seventh-warmest March on record in a series from 1884, with an average temperature of 7.8°C.

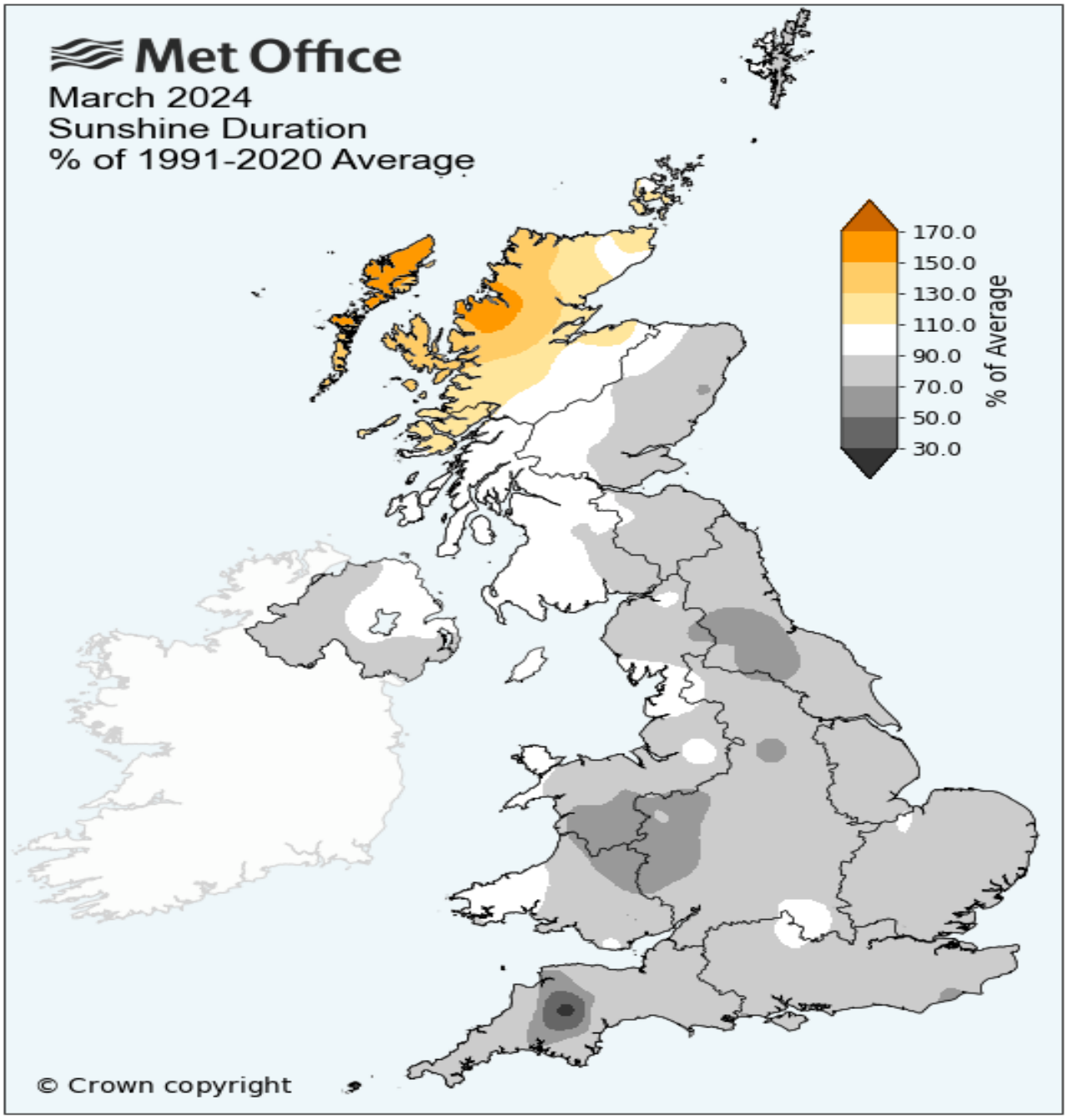
Met Office Scientist Emily Carlisle said: “Many will remember how wet March has been, with a succession of fronts and the influence of low pressure seemingly never too far away from the UK. Coming off the back of a wet winter and what has been a wet start to the year, many areas have very saturated ground, which has increased the sensitivity to rainfall events in recent weeks.”



Sunshine in short supply

Many of us have been looking forward to some welcome spring sunshine however, as you'd expect with the frequent rain, sunshine amounts have been in disappointingly short supply during March.

The UK recorded just 95.2 hours of sunshine for the month (87% of the long-term average). Scotland was the only region to have seen more than its average, with 4% extra sunshine hours than the average.



Provisional March 2024	Mean temp (°C)		Sunshine (hours)		Rainfall (mm)	
	Actual	Diff from avg (°C)	Actual	% of avg	Actual	% of avg
UK	6.7	1.0	95.2	87	107.8	127
England	7.8	1.4	93.4	80	94.3	162
Wales	7.0	1.1	86.8	79	158.2	153
Scotland	5.0	0.6	101.4	104	112.7	90

N Ireland	6.6	0.6	88.9	88	129.2	149

Date Created
April 2024

One ocean, one climate

Description

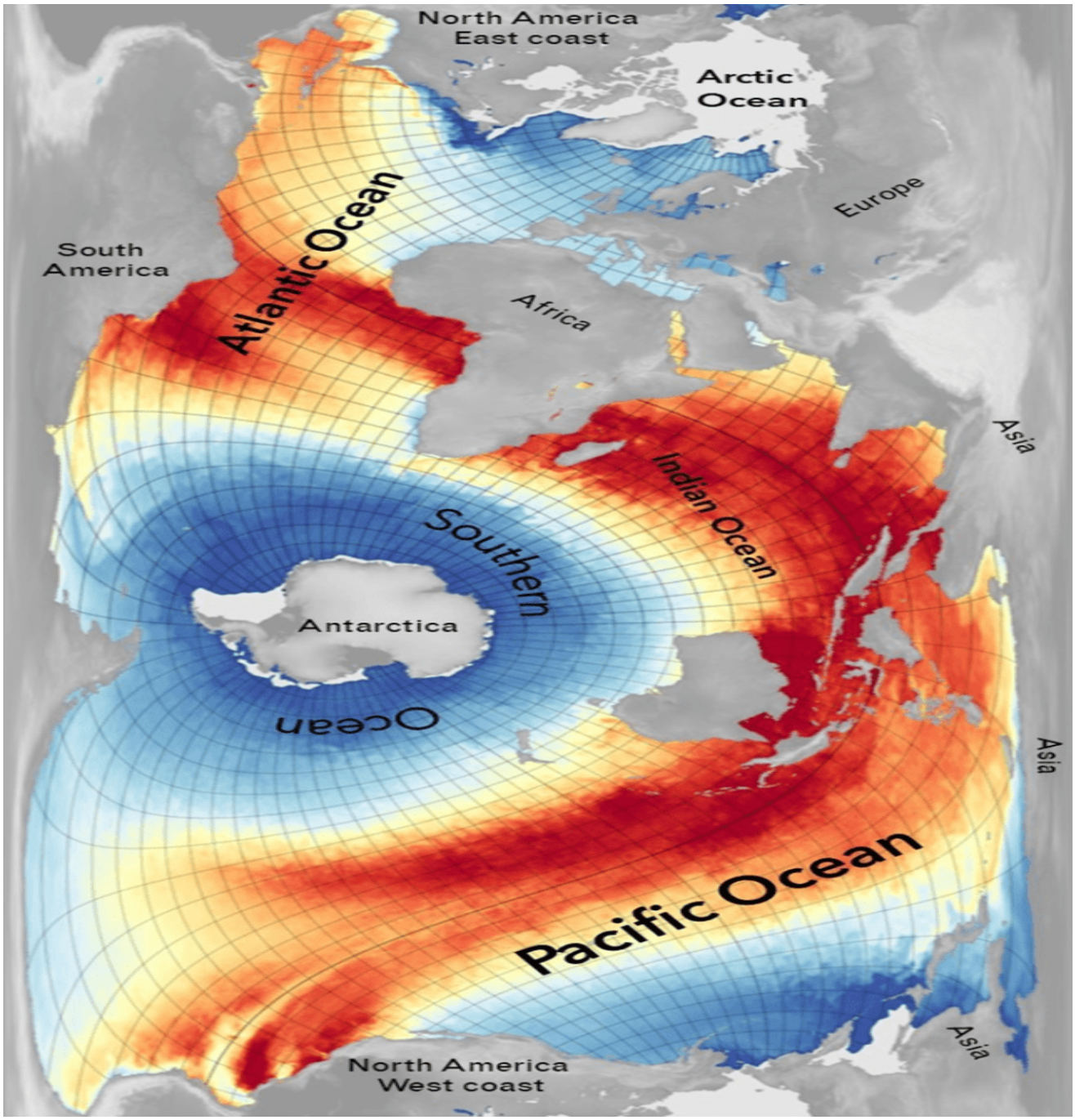
Our planet is covered in large part by water. Historically, the ocean was referred to as four oceans (Atlantic, Pacific, Indian, Arctic) or five if you included the Southern Ocean (around Antarctica).

For the ocean science community, it is now accepted there is only one global ocean- and many basins with individual names – says Christine Pequignet, a Met Office senior ocean forecasting scientist.

There are scientific reasons for this, and important societal consequences. Of course, if you swim off the coast of Hawaii after a lifetime of swimming in the water around Scotland, it will be difficult to recognise that you are in the same ocean. Yet, every ocean basin is connected to at least two others.

The shape of the ocean basins results from the evolution of one single supercontinent, Pangaea, which was surrounded by one super-ocean called Panthalassa. Like then, the forces that act upon the ocean today know no boundaries, for example the wind, gravity, the earth's rotation. The resulting circulation of water moves energy, organisms and matter – including pollution – around the globe.

The most common map projections, used to represent the earth on a flat surface, typically focus on land and divide the ocean. However, there are other map projections which instead focus on the ocean, such as the one here to display sea surface temperature, which highlight the inter-connection of the five ocean basins.



Map of Sea Surface Temperature plotted on a projection that emphasises the continuous nature of the world ocean (source: Philip Brohan Met Office)

The images we choose, the words we use, all contribute to the perception we have of the world and how we feel about it and how we act.

Talking about a global ocean reinforces the need to approach ocean issues in a universal manner. Knowing that actions on the ocean have both local and global impacts connects us to other communities and reinforces the critical need to protect the marine environment everywhere.

The ocean is a critical element of the climate system. At a time when the climate is changing at a rapid

rate, it is even more important to draw attention to the uniqueness of the ocean and the importance of its role in influencing our planet's climate. Noone questions the singular use of climate, despite the large range of climates observed around the globe and the variability in impacts that climate change will generate. Climate and ocean processes and issues are global. Along with one climate, there is one ocean.

During April we will be exploring the topic of the ocean and climate. Follow the #GetClimateReady hashtag on X (formerly Twitter) to learn more throughout the month.

Discover more about the one ocean concept.

Date Created
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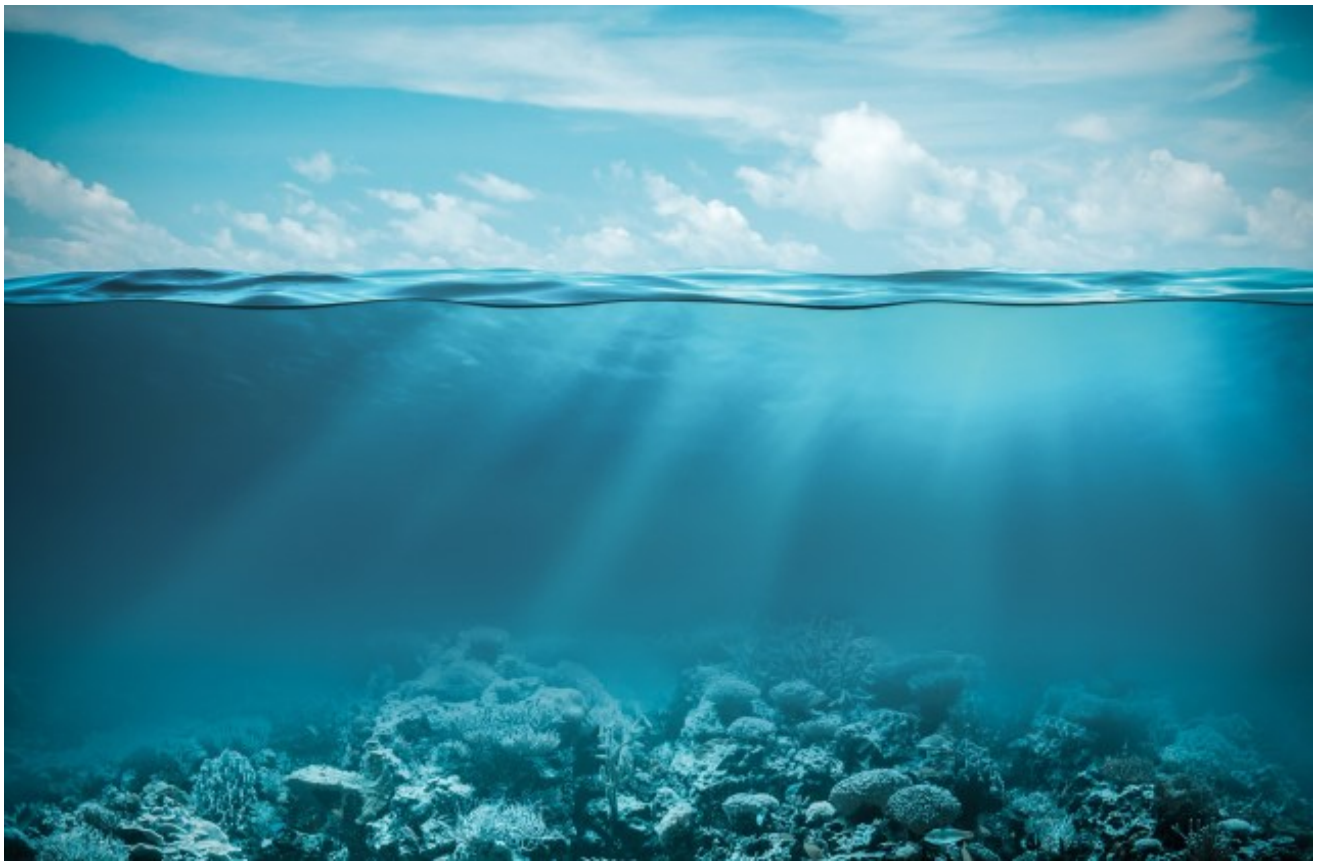
NEMO: a numerical ocean model

Description

A numerical ocean model is a computer programme representing the equations of motion (momentum, conservation of mass and thermodynamics) for the ocean. The model stores each of the physical properties of the ocean (temperatures, salinities and currents) on a three-dimensional grid, writes Ana Aguiar.



Ocean models store physical properties such as salinity, temperature and currents on a three-dimensional grid. Picture: Adobe Stock

Smaller ocean features can be resolved by using a finer grid with more points, but this requires more computational power. The model evolves these physical properties forward in time using its equations of motion. Models of sea ice and biogeochemistry work using similar principles.

Why do we need a numerical ocean model?

We need these models to predict the state of the ocean within short and long timescales for a variety of purposes, ranging from support to operations at sea (for example, search and rescue) to understanding the role of the ocean in the Earth's climate system. As the ocean sits beneath the atmosphere, sea-surface temperature patterns have widespread impact on the weather over land. Largely because two-thirds of the Earth is covered by ocean and the heat capacity of water

considerably outweighs that of the air, the ocean acts as a regulator of the atmosphere.

In polar regions temperatures become cold enough for seawater to freeze and sea ice forms on the surface of the ocean. Sea ice plays an important role in the climate system because it insulates the ocean from the colder atmosphere in winter and, being whiter than the ocean, reflects sunlight in the summer.

The NEMO modelling framework includes a sea-ice model component, known as SI³ (Sea Ice modelling Integrated Initiative). The sea-ice component is run along with the ocean component in a similar manner but using a different set of equations. To understand and prepare for climate change we need to account for the role of the ocean and sea ice.

How is the NEMO model developed?

Nucleus for European Modelling of the Ocean (NEMO) is a state-of-the-art ocean modelling framework. NEMO is developed by a European consortium with the objective of ensuring long-term reliability and sustainability of the code. In other words, the task of maintaining and developing such a complex computer programme requires a well-coordinated team effort, involves tens of developers and hundreds of users.

In the UK there are two member organisations: the Met Office and the National Oceanography Centre (NOC). Met Office Scientific Manager in Ocean Modelling, Ana Aguiar explains: “We work in partnership through the Joint Marine Modelling Programme, contributing to the development of NEMO. The code is publicly available for use in research and commercial applications. It is imperative to reach as many users as possible, to ensure the code gets tested and pushed to the limits of its usability. User requirements then prompt further advances.”

NEMO benefits from continual work to improve its performance (scientific and computational efficiency), to incorporate new scientific and process understanding, and to exploit the increase in supercomputer resources. When the developments are sufficiently mature and can provide significant scientific or technical improvements, a new NEMO version is released. Along with scientific upgrades (which tend to be increasingly computationally demanding), we must deliver code optimisation to make the best use of the available computing resources.
This video presents how NEMO is used by the Copernicus Marine Environment Monitoring Service.

What’s next?

The next NEMO release (expected to be rolled out this summer) will deliver significant improvements to model performance allowing it to run considerably faster. In the long term, among other things, we are also working towards porting the NEMO code to Graphical Processing Units (GPUs) to ensure continuity of the code in future mainstream High Performance Computing architectures

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Antarctic sea ice in 2023

Description

Each year, from June-October, polar climate scientists from the Met Office produce a series of monthly sea ice briefings for the government and the general public. These briefings describe the state of Arctic and Antarctic sea ice, compare how these relate to historic patterns, and, where possible, assess causes of unusual behaviour.

Sea ice is frozen seawater that floats on the surface of the ocean and is found when temperatures are cold enough for sea water to freeze. The extent of sea ice is a key climate indicator, because sea ice cover insulates the ocean in winter and reflects sunlight in summer, as well as providing a habitat for a range of species.

Here, Senior Scientist Alex West talks about the 2023 Antarctic sea ice minimum and its interaction with the ocean and atmosphere.

Lowest sea ice extent on record

Antarctic average sea ice extent for 2023 was the lowest on record. During the ice growth season from June-October, ice extent was exceptionally low for the time of year, reaching over 1 million square km below previous record lows and setting a new record low maximum extent by a very large margin. For much of the rest of the year, the ice was at record or near-record low levels, recording a second

successive record low minimum in February (Figure 1).

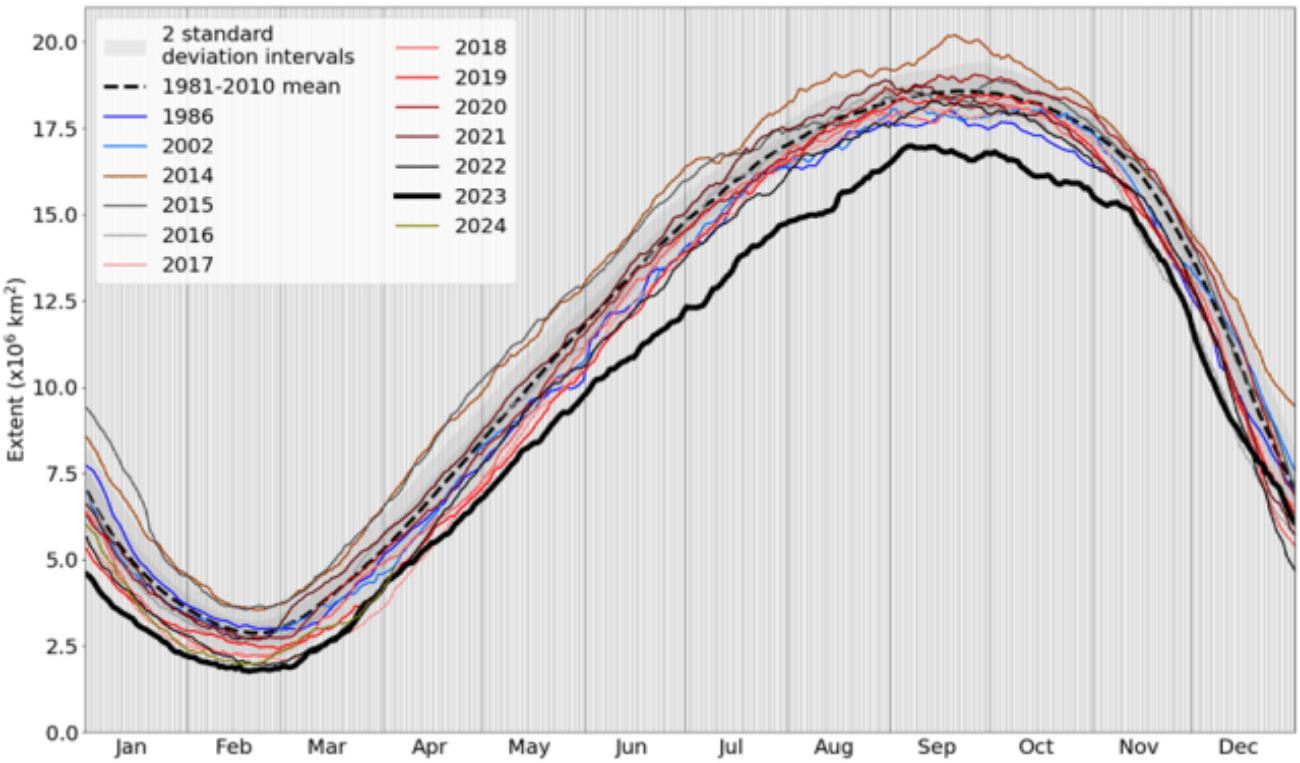

Figure 1. Antarctic sea ice extent in 2023 (bold black line) with other recent years indicated, as well as earlier years with notably low sea ice extent. The 1981-2010 average is also shown, with the shaded region indicating 2 standard deviation intervals.

The very low extent from June-October was partly caused by enhanced warm northerly winds, associated with persistent areas of high and low pressure (Ionita, 2024). Early in the ice growth season, from May-July, these were concentrated near the Antarctic Peninsula, in the Weddell and Bellingshausen Sea regions; later in the growth season, from August-October, the strongest winds were to be found further west, in the Ross Sea. The position of the lowest sea ice conditions changed similarly.

However, it is likely that the ocean also played a part. The low extent of 2023 continues a pattern of very high variability in Antarctic sea ice since 2007, with first high and then low sea ice conditions persisting for long periods of time, in a way unlikely to be caused by known atmospheric changes (Hobbs et al., 2024). A key moment in this period of high variability was a large reduction that occurred in 2016, and this is thought to be linked to changes in the upper ocean caused by stronger westerly winds mixing warmer waters below towards the surface (Earys et al., 2021; Zhang et al., 2022). Further mixing of warm waters cannot be ruled out as an additional cause of the very low extent of 2023.

The precise contribution of anthropogenic (human-caused) global warming to the record low sea ice of 2023 is not yet known. While climate models predict that Antarctic sea ice extent will decrease in response to anthropogenic warming, variability in the past 15 years has been considerable, with very high extent from 2012-2014 followed by the current period of very low extent (Figure 2). Further extreme variability in either direction remains possible in the years ahead.

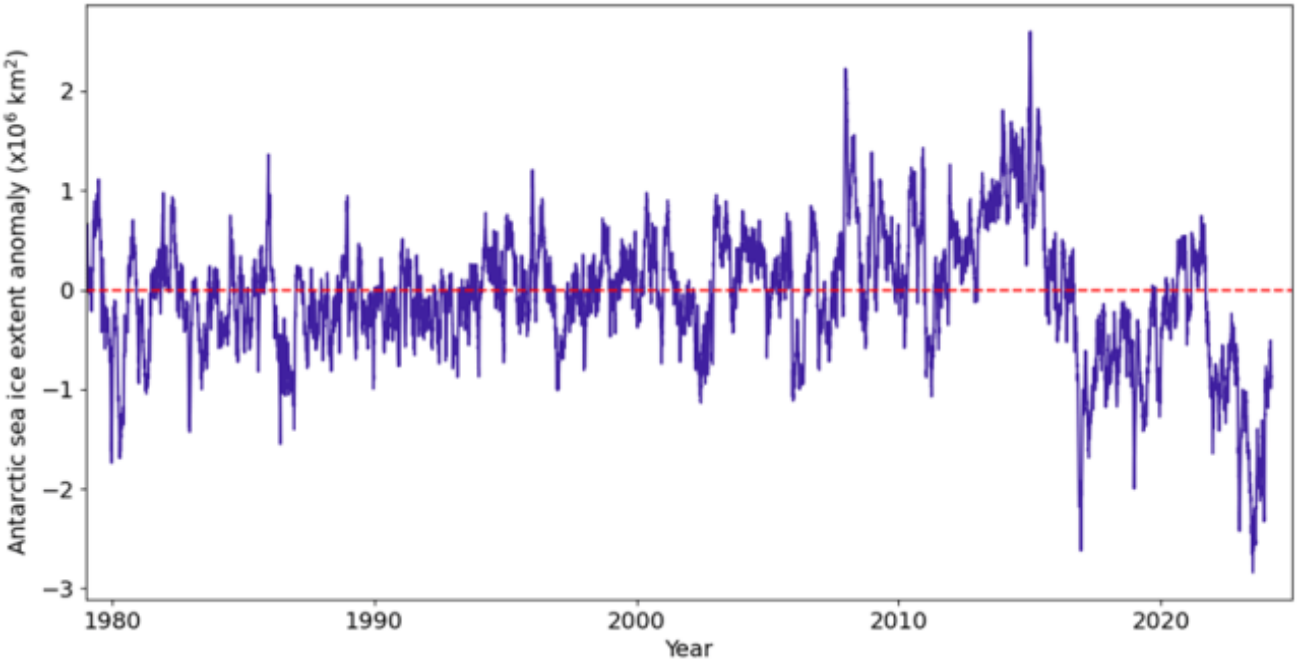

Figure 2. Antarctic sea ice monthly anomalies over the period of satellite observations. For each month, the 1981-2010 average ice extent for that month is subtracted. This largely removes the seasonal cycle so that subtler long-term changes can be viewed more easily.

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References

Eayrs, C., X. Li, M.N. Raphael and D.M. Holland (2021) Rapid decline in Antarctic sea ice in recent years hints at future change. Nat. Geosci., 14, 460–464. https://doi.org/10.1038/s41561-021-00768-3

Hobbs, W., and Coauthors (2024): Observational Evidence for a Regime Shift in Summer Antarctic Sea Ice. J. Climate, 37, 2263–2275, https://doi.org/10.1175/JCLI-D-23-0479.1

Ionita M (2024) Large-scale drivers of the exceptionally low winter Antarctic sea ice extent in 2023. Front. Earth Sci. 12:1333706, https://doi.org/10.3389/feart.2024.1333706

Zhang, L., T.L. Delworth, X. Yang, F. Zeng, F. Lu, Y. Morioka and M. Bushuk (2022) The relative role of the subsurface Southern Ocean in driving negative Antarctic Sea ice extent anomalies in 2016–2021. Commun. Earth Environ., 3, 302. https://doi.org/10.1038/s43247-022-00624-1

A map of Antarctica showing the Antarctic Peninsula separated by the Bellingshausen and Weddell Seas. Map: Adobe Stock.

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